

National Bureau of Standards Certificate

Standard Reference Material 930c Glass Filters for Spectrophotometry

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This Standard Reference Material is intended as a reference source for the verification of the transmittance and absorbance scales of spectrophotometers. It consists of three individual filters in their holders and one empty filter holder. Each filter bears an identification number, and the upper left corner has been removed to indicate correct placing in the metal holder.

Filter & Set Ident. Number	TRANSMITTANCE (T)					TRANSMISSION DENSITY ($-\log_{10} T$)				
	Wavelength and (Bandpass)					Wavelength and (Bandpass)				
	nm					nm				
	440.0 (2.2)	465.0 (2.7)	546.1 (6.5)	590.0 (5.4)	635.0 (6.0)	440.00 (2.2)	465.0 (2.7)	546.1 (6.5)	590.0 (5.4)	635.0 (6.0)

Date of Certification:

The transmittance values (T) can be converted to percent transmittance (%T) by multiplying by 100. The transmission densities are calculated from the measured transmittance (T). These values should be indicated by the absorbance scale of the spectrophotometer if the filters are measured against air.

The transmittance values given were measured against air at an ambient temperature of 23.5 °C, and are estimated to be accurate to within ± 0.5 percent at the time of certification. This uncertainty includes the random and systematic errors of the calibration procedure, as well as transmittance changes of the filters during the period of calibration.

It is possible that aging of the glass may cause some filters to change transmittance by about ± 1 percent over a period of approximately 1 year from the date of calibration. Improper storage or handling of the filters may also cause changes [5]. In cases where verification is desirable, the filters should be returned to the National Bureau of Standards for cleaning and recalibration.

It is recommended that the filters in the holders be handled only by the edges and with soft plastic (polyethylene) gloves and optical lens tissue. When not in use they should be stored in their holders and in the box provided for this purpose. Extended exposure to laboratory atmosphere and dusty surroundings should be avoided.

This Standard Reference Material was issued with the assistance and advice of K. D. Mielenz and J. R. DeVoe.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by T. W. Mears.

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J. Paul Cali, Chief
 Office of Standard Reference Materials

(over)

The transmittance measurements were made using the high-accuracy spectrophotometer designed and built at the Institute for Materials Research, National Bureau of Standards [1]. This instrument represents the primary transmittance standard; its transmittance accuracy was established using the double-aperture method of linearity testing [1,3,5,6]. The reproducibility (relative standard deviation obtained from a set of 20 measurements) of this high-accuracy spectrometer for transmittance measurements on glass filters of the SRM 930 type is approximately 0.04, 0.03, and 0.02 percent for $T = 0.1, 0.2$ and 0.3 , respectively. The combined uncorrected systematic error of the instrument is estimated to be not more than $\pm 10^{-4}$ transmittance units.

The neutral glasses for the filters were provided by Schott of Mainz, Germany and are designated as "Jena Color and Filter Glass." They are of the type NG-4 and NG-5, and their nominal transmittances are 10, 20, and 30 percent [2,5]. The glasses were selected to provide a means to verify the transmittance scale of conventional spectrophotometers at three levels. The exposed surface of the glass is approximately 29×8 mm, measuring from a point 1.5 mm above the base of the filter holder (see figure). The empty filter holder is provided to be used in the reference beam of the spectrophotometer so that approximately equivalent conditions of stray radiations are achieved for both beams.

The transmittance of the filters depends upon the intrinsic properties of the materials, spectral bandpass, wavelength, geometry of the optical beam, temperature, and positioning of the filter. A change of ambient temperature of 1 or 2 °C from 23.5 °C will not significantly affect the calibration [5]. Changes in the transmittance may be caused by surface conditions, aging of the glass, exposure to a harmful atmosphere, or careless handling as indicated on the face of this certificate [2,3,4,5]. The effective spectral bandpasses used to determine the certified values are given on the face of the certificate and the transmittance measurements are made by producing the vertical image of the slit (about 8 mm by 0.5 mm), using a convergent beam geometry with an aperture ratio $f:10$, in the middle of the entrance face of the glass filter. The filters were measured in the spectrophotometer in a position perpendicular to the incident light beam as shown in the attached figure.

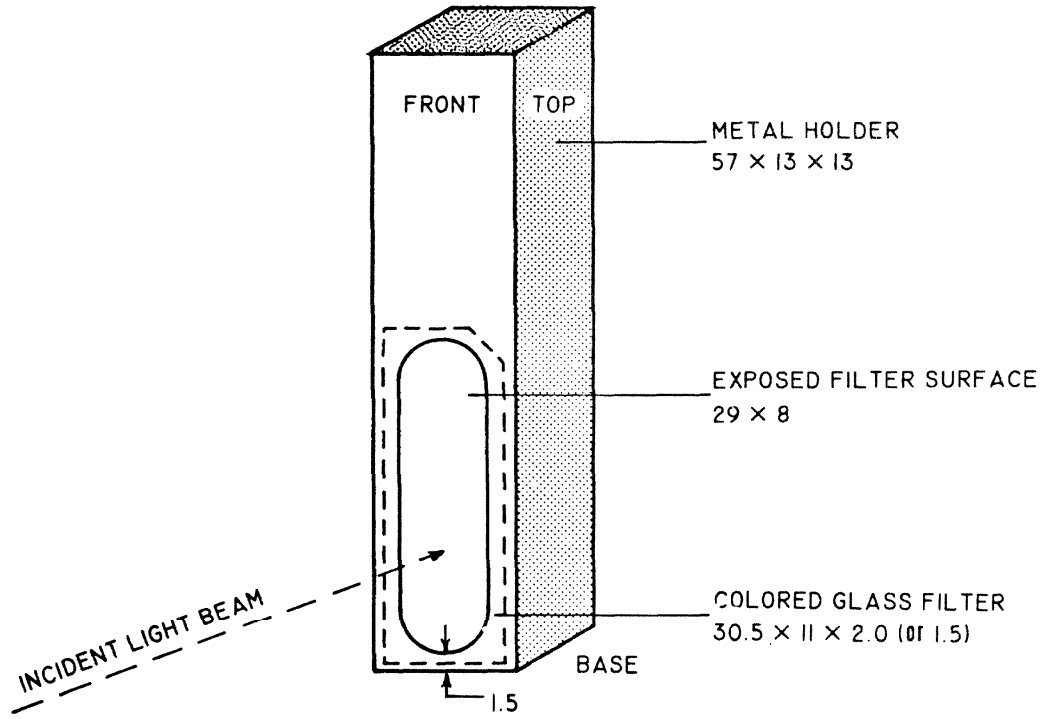
Prior to certification measurements, each filter was examined for surface defects and thoroughly cleaned [5]. Should the surface of the glass filter become contaminated, no attempt should be made to clean it unless the user has the facilities to demonstrate that the cleaning treatment has not altered the glass surface or degraded the accuracy of the certified values. Since the Standard Reference Material is a transfer standard, the only means available to verify its integrity is remeasuring its transmittance with a primary standard instrument similar to that used in this certification [1,4,5]. In most cases where verification, or recertification, of the transmittance values is desirable, it will be most expeditious to return the filters to the National Bureau of Standards for measurement. Prior to shipment the NBS Office of Standard Reference Materials should be contacted regarding the conditions and cost of verification and/or recertification.

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REFERENCES

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METAL HOLDER FOR THE COLORED GLASS FILTERS



DIMENSIONS IN mm